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Maine Agricultural Experiment Station

ORONO

BULLETIN 346 JULY, 1928

THE FOXGLOVE APHID

On Potato and Other Plants

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BULLETIN 346

THE FOXGLOVE APHID

On Potato and Other Plants[1]

By Edith M. Patch

The insect with which this bulletin is concerned first came to the attention of the writer in 1912 when specimens collected from peas at San Jose, California were submitted for determination. The next specimens of this species were received in 1916 from Canada where they were found to be infesting Easter lilies under glass. In 1922 collections of this aphid were made at Orono on plants representing five genera and four families. During 1923 and 1924 the Orono collections were taken from plants belonging to eleven genera. In 1925 the species was abundant near Orono and colonies were found on plants of sixteen genera.

It was not until 1926 that the writer felt justified in undertaking a serious study of this aphid. In May of that year, however, it was found infesting potato seedlings in a greenhouse at Aroostook Farm, Presque Isle, Me. As an insect attacking plants used in connection with potato disease investigations and subject to the suspicion of being a carrier of plant diseases, its life cycle, habits, and food plants became of enough significance to warrant attention. Experimental work, therefore, was conducted by the writer, and under her supervision, in Maine during the spring, summer and fall of 1926. This was followed by observations made by the writer in England in 1927.

The name *Myzus pseudosolani* was bestowed upon this insect by Professor Theobald of the South-Eastern Agricultural College, Wye, England in 1922 when he described it as a new species.* It is again recorded by this name by Professor Theobald in 1926** as "found so far only on potatoes and especially abundant on the sprouts of the seed." From this comment it is apparent that when collected from plants other than potato this species of aphid has

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[1]*Myzus pseudosolani* Theobald.

*The Aphides Attacking the Potato. S. E. Agr. Col. Bul. 1. p. 8.

**The Plant Lice or Aphididae of Great Britain. Vol. 1. p. 315.

been called by a name or names other than *M. pseudosolani.* It has not concerned the writer to attempt to ascertain what name has priority. For the purposes of this bulletin it will suffice to use, for this evidently introduced insect, the technical name by which, in European literature, it is at present known when attacking the potato, the crop with which it has had its chief economic association.

For a common name "foxglove aphid" is suggested because the foxglove is found to be its primary food plant—or that plant on which its over-wintering eggs are deposited.

SEASONAL HISTORY

In Maine the foxglove aphids deposit their over-wintering eggs on the common garden foxglove (*Digitalis purpurea* L.). Egg-laying in this locality begins late in September and extends through October the time varying somewhat with different weather conditions.

The eggs hatch in the spring and the aphids of the first generation, wingless forms called "stem-mothers", seek shelter between the folded parts of the growing leaves. The stem-mothers are slow in their development and are about a month in attaining full growth. On reaching maturity they do not lay eggs but produce their young viviparously.

Most of the individuals of the second generation, wingless like those of the first, are also hidden between the leaves. If the infestation is not excessive the early forms do the foxgloves no conspicuous damage and they ordinarily escape notice unless the plants be given careful examination.

The aphids of the third generation, in turn produced viviparously, are likely to feed exposed on the rapidly growing stalks of the foxgloves and, if abundant, the colonies are easily seen. With their last molt they become winged. They then desert the foxgloves, for the most part, and fly to other plants more acceptable to the summer generations. A list of such plants, so far known to the writer, is given in this bulletin, beginning on page 54. In Maine the earliest of the migrants leave the foxglove in June.

On the various food plants colonized by the summer aphids both wingless and winged females develop, the latter serving as dispersal forms as they leave the parent colonies for other plants.

Late in the summer winged females, known as the fall migrants, are particularly attracted by the species of plant deserted by the spring migrants. In September and October, in Maine, the descendants of the fall migrants, comprising wingless males and oviparous females, are found on the foxglove. It is only once in the annual cycle that these forms appear. After mating, the females deposit the over-wintering eggs which are attached to the foxglove where they remain until spring before hatching.

In a cold climate these aphids have no means other than the egg stage of passing the winter out of doors. In a climate temperate and moist enough to provide acceptable plants, successive generations of viviparous females could doubtless carry this species through from year to year as is the case with related aphids. Since the foxglove aphids frequently infest greenhouse plants, the viviparous forms may continue under glass during the winter even in localities where these forms cannot subsist during this season out of doors.

The foxglove has been introduced from Europe to America and here it is found only in gardens, except in localities where it has become a casual escape from gardens. The status of its relation to the same species of aphid in places where the foxglove is native is a matter of interest. It was, therefore, with no little curiosity that the writer made examination of purple foxgloves in several parts of England, North Wales, and Scotland during the season of 1927.

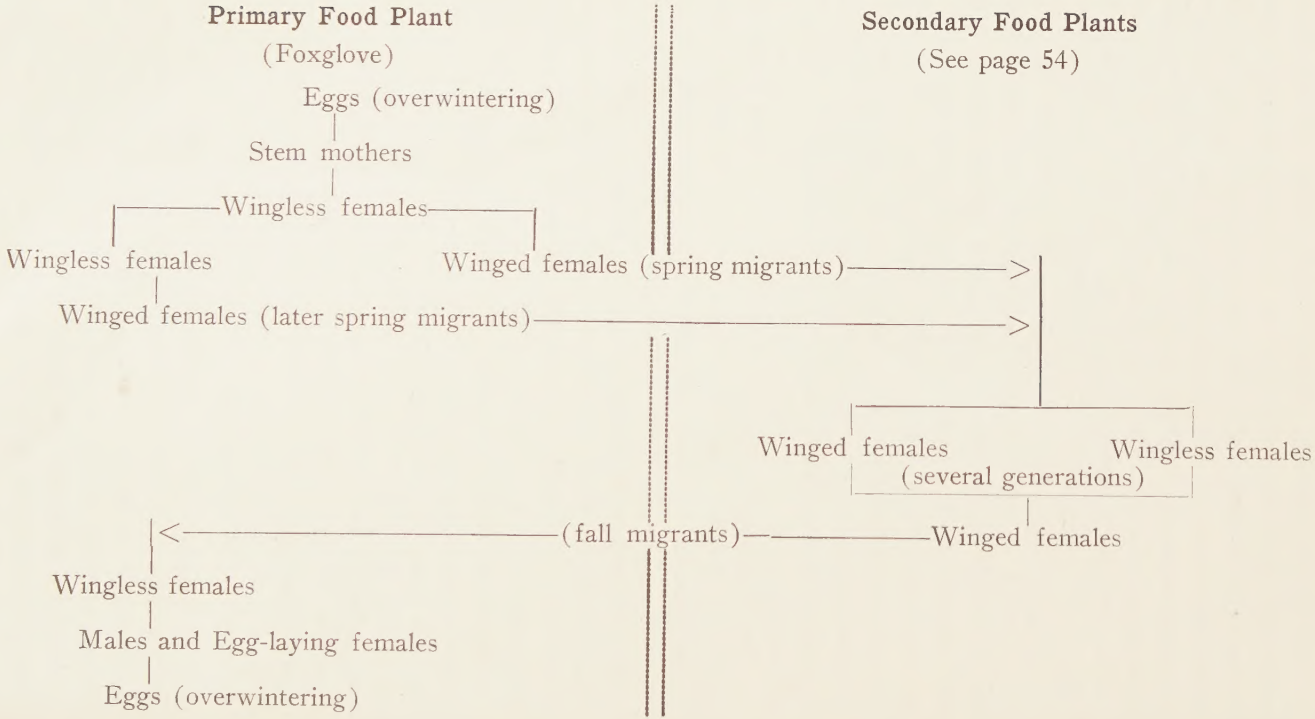
Such examination resulted in finding spring forms of the foxglove aphids on foxglove as follows: Oxted, Surrey, England, May 29; Pont Cwm-bydew, Berwyn Mountains, miles from human habitation, and near Harlech, North Wales, June 12; Keswick, England, June 23; Glencoe, Scotland, June 27; York, England, July 2, where the colonies were more advanced and the infestation heavy, the aphids crowding the blossom stalks.

Food Plants of the Foxglove Aphid

The foxglove aphids recorded from the plants in this present list have been examined by the writer. Unless otherwise indicated the data refer to Maine specimens. Accession numbers followed by asterisks apply to material submitted to experimental conditions.

No. 107-26 is the number given to a rather small lot of foxglove aphids collected from foxglove at Freeport, Maine, June 26,

SEASONAL CYCLE OF THE FOXGLOVE APHID



1926 for use in feeding experiments. Descendants of this lot are indicated by sub-numbers, a different one assigned to the aphids used in each experiment. Successive generations of viviparous females, both winged and wingless, descended from 107-26, thrived during the summer on certain plants to which they were given access under experimental observation, and there were many thousands of the viviparous females and young present when the experiments were discontinued November 1, 1926. In addition to the viviparous forms, males and oviparous females matured during the last week in September and later. Upon every plant named in this list associated with a sub-number under 107-26, foxglove aphids, after being introduced, remained feeding and reproducing young which, in turn, settled and fed through their several stages of growth to maturity. With insects so discriminating in their diet as are aphids a test which thus satisfies individuals of two successive generations seems sufficient to be considered affirmative. Many of the sub lots, however, represent a much longer period than this necessary margin. The plants in this experiment varied considerably in respect to nutritive value as was evidenced by the more rapid growth of the aphids on certain plants, their larger size and the more populous colonies produced. Such differencies may be in part inherent in the plant species and in part due to the fact that certain kinds of plants are less thrifty when kept under control conditions than when growing normally in the open.

Eng-7 is the number assigned to material received by the writer at the Rothamsted Experimental Station, May 10, 1927 on blossom stalks of Calla lily. On May 10 clean potato stalks were placed in the same glass with the Calla, the leaves being in contact with the infested stem and blossom. By May 13 the potato stalks were already heavily colonized with aphids, both mature wingless females and young feeding quietly on the potato. On May 26, bits of infested potato stalks and leaves were placed on freshly cut shoots of common avens, chervil, dock, and sowthistle. As the potato wilted, the aphids settled on all four of these plants and were still contentedly feeding and reproducing on June 2 when the material was discarded. Obviously a 7-day feeding test is too brief for the conclusive 2-generation data obtained with 107-26 but in view of the prolonged tests of the previous year with American material, it was not considered necessary to devote so much attention to the species in England. Except for those specimens

used, as just indicated, in the experiments started May 26, the aphids voluntarily colonizing potato (from Calla) May 10-13, as previously noted, remained feeding on potato until June 2 when they were discarded. At that time, after twenty days on potato, they had so greatly increased in numbers that the original stalks and several added later were all crowded with both wingless mature females and young. Newly developed winged females were also present. Both winged and wingless forms of this lot (Eng-7) were submitted by Dr. J. Davidson to Professor Theobald who confirmed the determination of *Myzus pseudosolani* Theobald.

Number Eng-39 was given a collection of wingless females of the spring generation made by the writer from foxglove at Oxted, Surrey, England, May 29, 1927. On May 30 the aphids were transferred to cuttings of bittersweet on which mature females and their young remained feeding until June 8 when potato stalks were placed in contact with the bittersweet leaves. The potato proved more attractive so that by June 9 most of the mature aphids had already moved over to the fresh stalks where they settled and established colonies so populous that by June 17 the potato stalks were crowded with their progeny. The test was discontinued on that date in view of the fact that the writer had repeatedly conducted successful transfer from foxglove to potato with Maine material.

The following list includes the names of all the plants at present personally known to the writer to be acceptable to the foxglove aphid. The list represents thirty-one botanic families. In view of so broad a range of diet there is no doubt that future collections in various countries will result in finding that many additional plants are colonized by this species of insect.

WATER-PLANTAIN FAMILY

Arrow-head, *Sagittaria latifolia* Willd.: 468-26.
Water plantain, *Alisma Plantago-aquatica* L.: 540-25; 639-25.

ARUM FAMILY

Calla lily, *Zantedeschia* (*Aroides*) (*Calla*) *æthiopicum*, Spreng.: Eng-7, England, 1927, greenhouse.

PICKEREL-WEED FAMILY

Pickerel-weed, *Pontederia cordata* L.: 107-26 sub 32*.

LILY FAMILY

Easter lily, *Lilium longiflorum* Thunb.: 14-16, Canada, greenhouse.

IRIS FAMILY

Gladiolus, *Gladiolus* sp.: 107-26 sub 53*.

ORCHIS FAMILY

Rein orchis, *Habenaria dilatata* (Pursh) Gray: 107-26 sub 37*.

BUCKWHEAT FAMILY

Bitter dock, *Rumex obtusifolius* L.: 293-22B; 362-25.
Yellow dock, *Rumex crispus* L.: 110-25; 461-25; 107-26 sub 7*; 260-27.
Dock, *Rumex* sp.: 259-26; 328-26; 366-26; Eng-7 sub 1*, England; 430-27.
Black bindweed, *Polygonum convolvulus* L.: 488-26.
Common smartweed, *Polygonum Hydropiper* L.: 348-26; 107-26 sub 28*.
Sacaline, *Polygonum sachalinense*, F. Schmidt.: 254-22; 45-23.

GOOSEFOOT FAMILY

Lamb's quarters, *Chenopodium album* L.: 418-26; 524-26.

AMARANTH FAMILY

Green amaranth, *Amaranthus retroflexus* L.: 371-26.
Green amaranth, *Amaranthus hybridus* L.: 469-26.

PINK FAMILY

Common chickweed, *Stellaria media* (L.) Cyrill.: 264-25; 107-26 sub 9*; 407-26.
Common mouse-ear chickweed, *Cerastium vulgatum* L.: 419-26; 475-26; 526-26.

PURSLANE FAMILY

Common purslane, *Portulaca oleracea* L.: 280-23; 107-26 sub 27*; 107-26 sub 35*; 409-26.

CROWFOOT FAMILY

Creeping buttercup, *Ranunculus repens* L.: 107-26 sub 39*; 368-26; 266-27.
Tall buttercup, *Ranunculus acris* L.: 677-23; 63-25; 107-26 sub 6*; 260-26; 523-26.
Garden Columbine, *Aquilegia vulgaris* L.: 107-26 sub 39*; 480-26; 266-27.

MUSTARD FAMILY

Shepherd's purse, *Capsella Bursa-pastoris* (L.) Medic.: 107-26 sub 2*; 188-26; 338-26; 483-26.

SAXIFRAGE FAMILY

Mock-orange, *Philadelphus coronarius*, L.: 194-24; 236-24; 123-25; 413-25; 519-25; 107-26 sub 1*.

ROSE FAMILY

Apple, *Pyrus Malus*, L.: Eng-111, England, 1927.
Common avens, *Geum urbanum* L.: Eng-7 sub 2*, England, 1927.
Cinquefoil, *Potentilla canadensis* L.: 164-25.
Cinquefoil, *Potentilla norvegica* L.: 107-26 sub 43*.
Hawthorn, *Crataegus* sp.: 160-22.
Strawberry, *Fragaria virginiana* Duchesne: 549-23; 169-25; 353-27.
Strawberry, *Fragaria chiloensis*, Duchesne.: 476-26.

PULSE FAMILY

Alsike clover, *Trifolium hybridum* L.: 107-26 sub 10*.
Red clover, *Trifolium pratense* L.: 354-26; 464-26.
White clover, *Trifolium repens* L.: 408-26.
Garden pea, *Pisum sativum* L.: 117-12, California.

ST. JOHN'S-WORT FAMILY

Common St. John's-wort, *Hypericum perforatum* L.: 465-26.

VIOLET FAMILY

Pansy, *Viola tricolor* L.: 662-25; 107-26 sub 55*; 478-26.
Violet, *Viola cucullata* Ait.: 440-23.

EVENING PRIMROSE FAMILY

Common evening primrose, *Oenothera biennis* L.: 676-23; 713-23.

GINSENG FAMILY

Bristly sarsaparilla, *Aralia hispida* Vent.: 307-25; 468-25; 347-26.

PARSLEY FAMILY

Celery, *Apium graveolens* L.: 107-26 sub 52*.
Chervil, *Chaerophyllum* sp.: Eng-7 sub 3*. England, 1927.
Water parsnip, *Sium cicutaefolium* Schrank.: 467-26.

DOGWOOD FAMILY

Red-osier dogwood, *Cornus stolonifera* Michx.: 107-26 sub 33*.

PRIMROSE FAMILY

Bulb-bearing loosestrife, *Lysimachia terrestris* (L) BSP.: 157-25; 187-25; 542-25; 300-26; 462-26.
Fringed loosestrife, *Steironema ciliatum* (L.) Raf.: 107-26 sub 20*.

VERVAIN FAMILY

Vervain, *Verbena* sp.: 455-27.

MINT FAMILY

Common hemp nettle, *Galeopsis Tetrahit* L.: 327-26.
Scarlet sage, *Salvia splendens* Ker.: 641-25; 642-25; 672-25.

NIGHTSHADE FAMILY

Bittersweet, *Solanum Dulcamara* L.: 95-25; 150-25; 208-25; 282-25; 107-26 sub 30*; Eng-39 sub 1*, England, 1927.
Jerusalem-cherry, *Solanum Pseudo-Capsicum*, L.: 107-26 sub 31*.
Potato, *Solanum tuberosum* L.: 730-25 sub 21, British Columbia; 4-26, greenhouse; 18-26; 107-26 sub 11*; 435-26; 553-26 sub 1, Montana; Eng-39 sub 2*, England, 1927.

FIGWORT FAMILY

Beard-tongue, *Pentstemon* sp.: 107-26 sub 56*.
Common mullein, *Verbascum Thapsus* L.: 380-26.
Common speedwell, *Veronica officinalis* L.: 107-26 sub 29*.
Foxglove, *Digitalis purpurea* L.: 213-22A; 675-23; 667-25; 91-26; 107-26; 107-26 subs 50* and 51*; 303-26; 345-26; 378-26; 415-26; 481-26; 487-26; Eng-39, England, 1927; Eng-56, North Wales, 1927; Eng-xx, Scotland, 1927.

PLANTAIN FAMILY

Common plantain, *Plantago major* L.: 284-23; 291-23; 107-26 sub 17*; 357-26.
Rib grass, *Plantago lanceolata*, L.: 463-26.

HONEYSUCKLE FAMILY

Cranberry-tree, *Viburnum Opulus* L., Var. *americanum* (Mill).: 251-26.

BLUEBELL FAMILY

Creeping Campanula, *Campanula rapunculoides* L.: 107-26 sub 38.

COMPOSITE FAMILY

Beggar-tick, *Bidens frondosa* L.: 107-26 sub 34*.
Common groundsel, *Senecio vulgaris* L.: 265-25.
Common tansy, *Tanacetum vulgare* L.: 466-26.
Cudweed, *Gnaphalium* sp.: 413-26.
Fall dandelion, *Leontodon autumnalis* L.: 226-22; 71-23; 520-24; 124-25; 107-26 sub 22*.
Golden-rod, *Solidago* sp.: 340-26; 525-26.
Orange hawkweed, *Hieracium aurantiacum* L.: 93-25; 107-26 sub 23*; 372-26.
Ox-eye daisy, *Chrysanthemum Leucanthemum* L.: 107-26 sub 12*; 356-26; 373-26.
————, *Chrysanthemum* sp.: Eng-59, England, 1927.
Pineapple-weed, *Matricaria suaveolens* (Pursh): 98-27.
Roman wormwood, *Ambrosia artemisiifolia* L.: 107-26 sub 14*; 346-26.
Sow thistle, *Sonchus* sp.: Eng-7 sub 4*, England, 1927.

FIG. 8. A-G, Winged Female: A, head; B, antenna; C+D, III of other individuals, showing variation in number of sensoria; E, cornicle; F, cauda; G, wings. H-L, Wingless Viviparous Female: H, head; I, antenna; J, III of another individual with three sensoria; K, cornicle; L, cauda. M-Q, Oviparous Female: M, head; N, cornicle; O, cauda; P, hind tibia; Q, antenna. R-V, Wingless Male: R, head; S, antenna; T, III in different position; U, cauda; V, cornicle. All drawings, except the wings, drawn to same magnification.

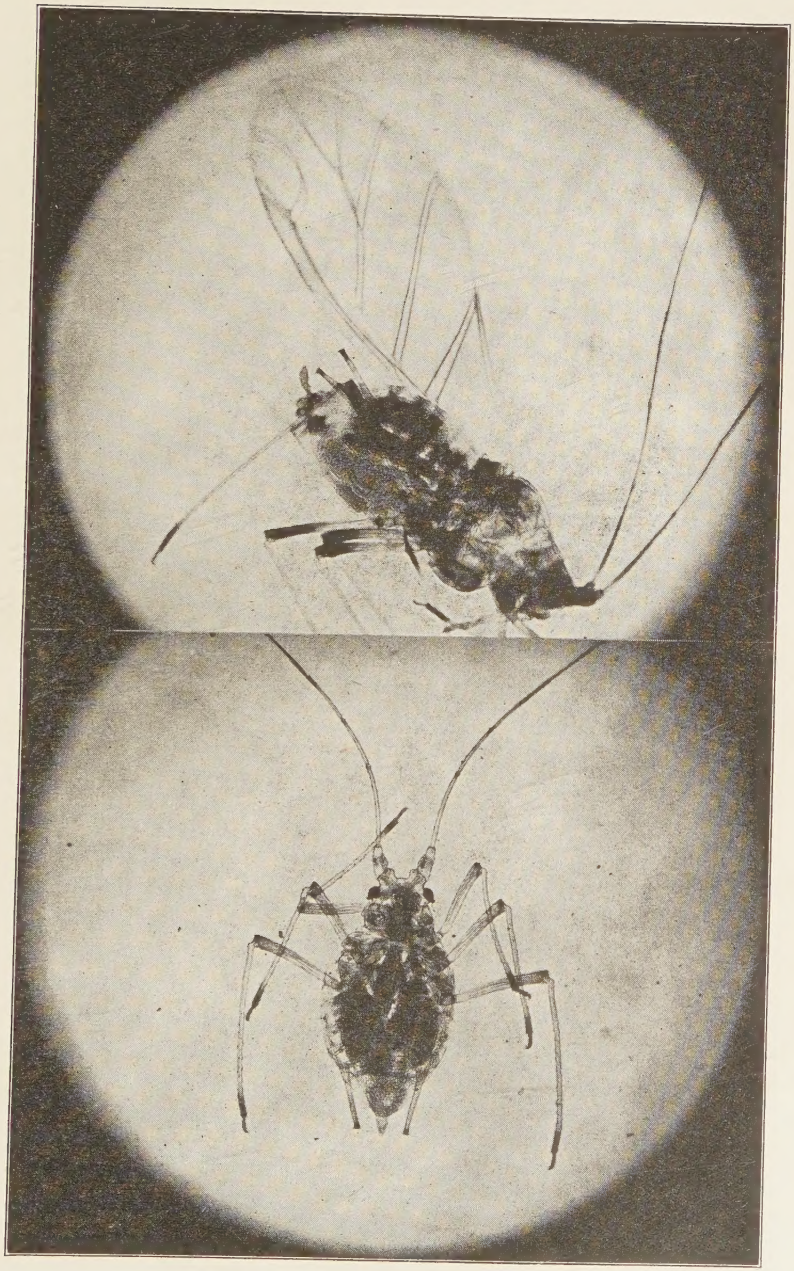


FIG. 9. Winged and wingless viviparous females.

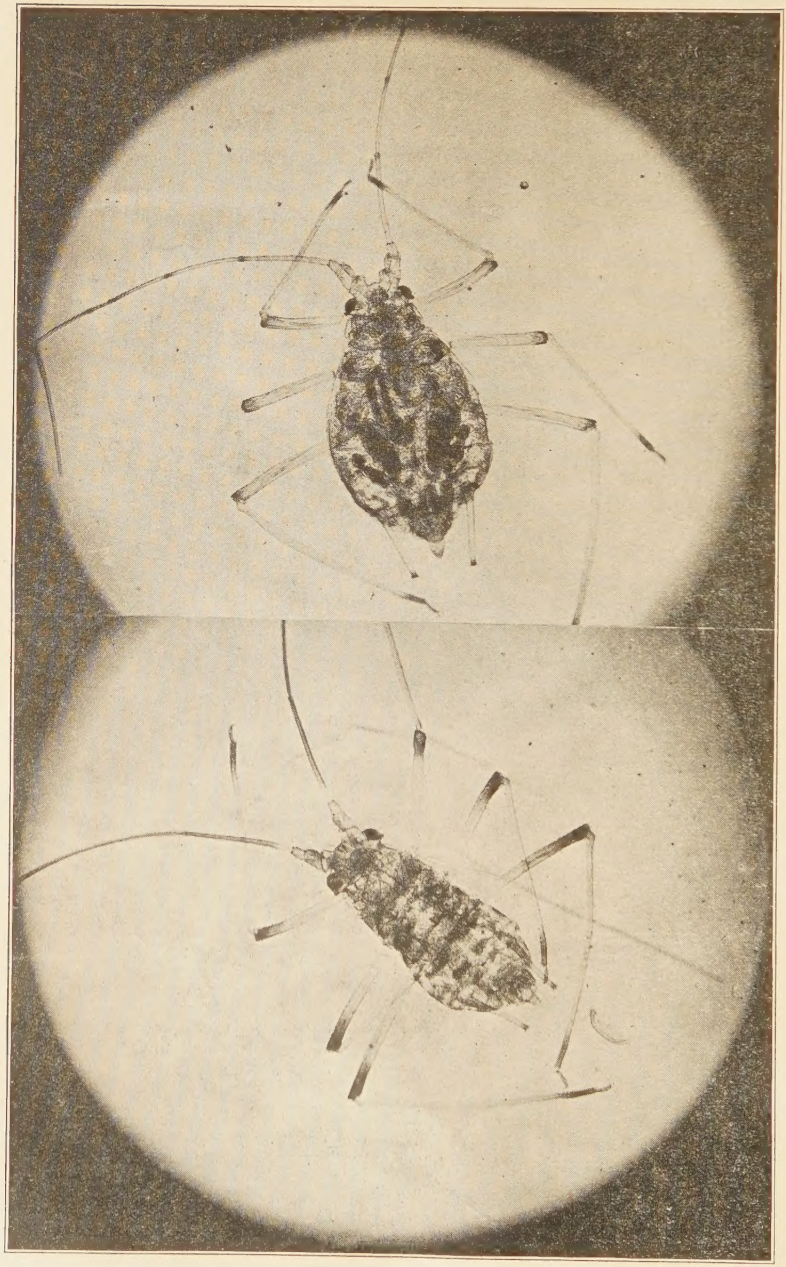


FIG. 10. Oviparous female, above. Male, below.